

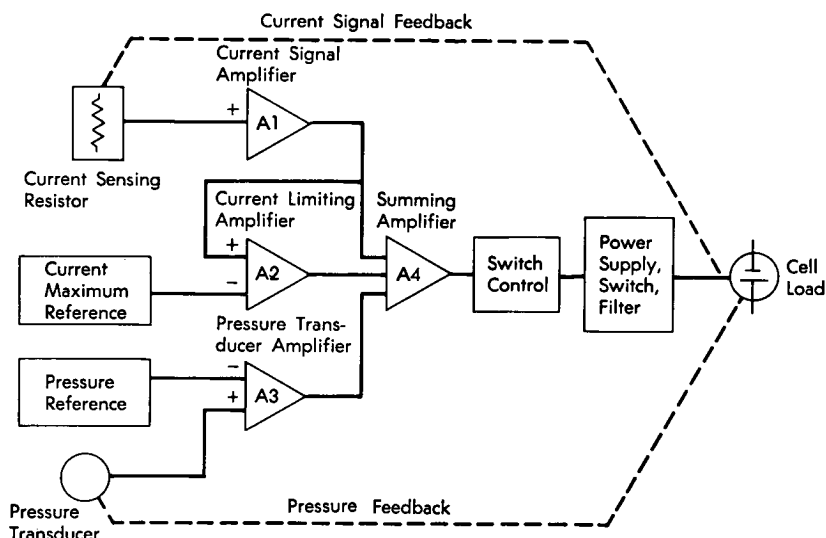
# NASA TECH BRIEF

## Ames Research Center



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### Oxygen Pressure Control for Electrolysis Cells



#### The problem:

To provide oxygen at a constant pressure from a cell which electrolyzes water. With the usual control circuits, when the oxygen demand is so great that the pressure is low, the electrolytic cell may be damaged by excessive current.

#### The solution:

A pressure sensor controls the duty cycle of a switched, constant current circuit. DC power is connected to a series circuit consisting of a semiconductor switch, a smoothing filter, the load, and a current-measuring shunt. The switch is turned on and off at a fixed rate. The duty cycle is controlled by feedback from the current shunt and a pressure signal to maintain constant-load current which is inversely pro-

portional to pressure and independent of input voltage or load impedance changes within operational limits.

#### How it's done:

Since an electrolysis cell stack requires a large amount of power, a switching-mode regulator was selected to keep size and weight down while keeping efficiency high. To keep the filter components as small as possible, a pulse-width-modulation (PWM) system operating at a frequency of 10 kHz was chosen.

In order to provide a closed-loop pressure control system, a pressure transducer is installed in the oxygen line of the stack. The pressure transducer signal is fed to amplifier A3 (see figure); the amplifier is phased so that an increase in pressure causes the power conditioner output current to decrease. The

(continued overleaf)

current-limiting circuit shown in the figure was designed to prevent excessive stack current which may result at start-up, or during period of oxygen drain, when the pressure is low. When the output current reaches a value such that the voltage output of A1 becomes equal to the reference connected to the input of A2, the output of A2 changes to limit the output current.

Below 77 psig (632 kN/m<sup>2</sup> abs.), the current-limiter holds the cell current constant at 30 amperes; when the pressure rises above 77 psig, the pressure transducer takes over control of the current. At the operating point of 80 psi (552 kN/m<sup>2</sup>) and 23 amperes, oxygen flow is balanced. If the pressure increases above this point, the cell current is lowered to reduce oxygen production until the pressure falls back to the operating point.

#### **Notes:**

1. Current rating, voltage compliance, and control methods can be easily varied to adapt the supply to other applications.
2. Additional information may be obtained from:  
Technology Utilization Officer  
Ames Research Center  
Moffett Field, California 94035  
Reference: TSP72-10074

#### **Patent status:**

No patent action is contemplated by NASA.

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